

Product Note #0046
Force Measurement of Actuator using Differential Pressure
Transducers and 9243 Strain Gauge Amplifier

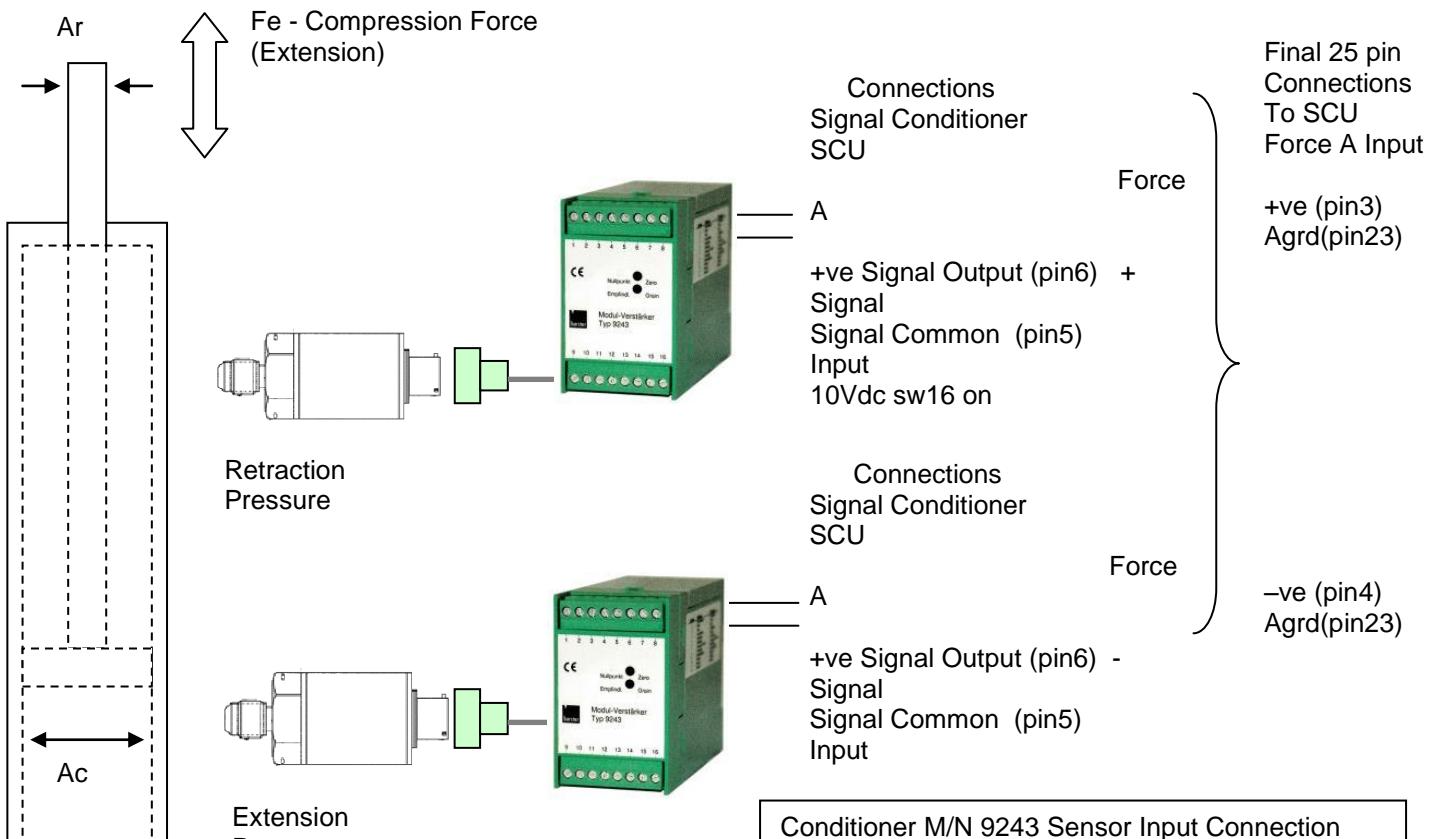
Description:

The following measurement system achieves Force Measurement of an Actuator using Differential Pressure Transducers

Motivation:

In applications where a load cell cannot be mounted, and coarse force measurement is suitable.

Solution:



Conditioner M/N 9243 Sensor Input Connection Table

Function	+exc	+sen	+sig	-sig	-exc	-sen
Pin #	11	12	14	13	9	10



Fe = (**Ae** * **Pe**) representing the resulting Compression Force (Extension)

Me = **SOe** / **Sle**

Where, **Ae** is the effective internal actuator area. (8.30 sq.in.)

Pe at 3000 lb/sq.in. has a F.S. output of 154.59mV (-4.02mV at 0 psi)

Me is representative of the Volt / lb. Conversion to Eng. Units (F.S. = 9.955 Vdc)

Sle is the Signal Input that represents F.S. pressure

SOe is the Signal Output that represents F.S.

Internal Friction Loss and Amplifier Unbalance are assumed as 0 at this time

Thus **Fe** = (8.30 sq.in. * 3000 lb/sq.in.) = 24,887 lbs.

Me = **SOe** / **Sle** = 9.955 Vdc / 0.15861V = 62.764 Gain (100mVi/p = 6.2764 Vo/p)

Fr = (**Ar** * **Pr**) representing the resulting Tension Force (Retraction)

Mr = **SOr** / **Sir**

Where, **Ar** is the effective internal actuator area **Ac** - **Ar**. (5.89 sq.in)

Pr at 3000 lb/sq.in. has a F.S. output of 135.18mV (-2.78mV at 0 psi)

Mr is representative of the Volt / lb. Conversion to Eng. Units (F.S. = 7.069 Vdc)

Sir is the Signal Input that represents F.S. pressure

SOr is the Signal Output that represents F.S.

Internal Friction Loss and Amplifier Unbalance are assumed as 0 at this time

Thus **Fr** = (5.89 sq.in * 3000 lb/sq.in.) = 17,671 lbs.

Mr = **SOr** / **Sir** = 7.069 Vdc / 0.13796 Vdc = 51.239 Gain (100mVi/p = 5.1239 Vo/p)

NOTE: Turn off the Ratiometric Voltage in the Force Cal. Of the SCU properties

This theoretical analysis does not consider errors due to Actuator internal friction.

Thermal errors of the instrumentation are as follows:

9243 Amplifier Errors (Static plus Thermal) – 0.05%F.S. plus 0.05% / 10deg.C. = **0.1% F.S./ 10deg.C. variation**

Sensor Errors (Static plus Thermal) - 0.1% F.S. plus 0.4% / 10deg.C. = **0.5% F.S./ 10deg.C. variation**